CLAIMS

What is claimed is:

1. A method comprising:

dispersing zeolite particles in a liquid sol to form a zeolite – sol colloid;

depositing the zeolite – sol colloid on an underlying layer; and

forming the zeolite – sol colloid into a wet gel – zeolite composite.

2. The method of claim 1, wherein forming the zeolite – sol colloid into the wet gel – zeolite composite comprises:

extracting at least some of the liquid from the zeolite – sol colloid to form the wet gel – zeolite composite.

3. The method of claim 2, wherein extracting at least some of the liquid comprises:

drying the zeolite – sol colloid.

4. The method of claim 3, wherein drying the zeolite – sol colloid comprises:

oxidizing the zeolite – sol colloid.

5. The method of claim 2, wherein extracting at least some of the liquid comprises:

vacuuming the liquid out of the zeolite – sol colloid.

6. The method of claim 2, wherein extracting at least some of the liquid comprises:

heating the zeolite – sol colloid.

7. The method of claim 6, wherein the zeolite – sol colloid is heated under a vacuum.

8. The method of claim 1, further comprising:

calcinating the wet gel – zeolite composite.

9. The method of claim 8, wherein calcinating the wet gel – zeolite composite comprises:

heating the wet gel – zeolite composite; and

cooling the wet gel – zeolite composite.

10. The method of claim 9, wherein the wet gel – zeolite composite is heated under a vacuum.

11. The method of claim 8, wherein calcinating the wet gel – zeolite composite to form a composite gel-zeolite dielectric layer comprises:

oxidizing the wet gel – zeolite composite.

12. The method of claim 2, further comprising:

forming the wet gel – zeolite composite into an aerogel – zeolite composite.

13. The method of claim 12, wherein forming the wet gel – zeolite composite into an aerogel – zeolite composite comprises extracting approximately all of the remaining liquid from the wet gel – zeolite composite.

14. The method of claim 13, further comprising calcinating the aegogel – zeolite composite.

15. The method of claim 1, wherein dispersing the zeolite particles in the liquid sol comprises:

stirring a first amount of zeolite into the liquid sol.

16. The method of claim 15, wherein the first amount of zeolite is molar percentage of the zeolite – sol colloid.

17. The method of claim 16, wherein the molar percentage of zeolite is in the range of one to fifty percent.

18. The method of claim 1, wherein the sol is a silica sol.

19. The method of claim 1, wherein the sol comprises an alcohol.

20. The method of claim 19, wherein the alcohol is selected from the group consisting of ethanol, methanol, 1- or 2-propanol, or 1-butanol.

21. The method of claim 19, wherein the sol further comprises an acid.

22. The method of claim 21, wherein the acid is selected from a group consisting of hydrochloric (HCl), nitric, sulfuric, phosphoric, hydrofluoric (HF), acetic, or citric acid.

23. The method of claim 21, wherein the sol further comprises a silicon precursor.

24. The method of claim 23, wherein the silicon precursor is selected from a group consisting of tetraethozysilane (TEOS), tetramethozxysilane (TMOS), tetrapropozysilane (TPOS), and tetrabutoxysilane (TBOS).

25. The method of claim 23, wherein the sol further comprises a surfactant.

26. The method of claim 25, wherein the surfactant is selected from a group consisting of hydrochloric (HCl), nitric, sulfuric, phosphoric, hydrofluoric (HF), acetic, or citric acid.

27. The method of claim 1, wherein depositing the zeolite – sol colloid comprises: spin-coating the zeolite – sol colloid on the underlying layer.

28. The method of claim 1, wherein depositing the zeolite – sol colloid comprises: dip-coating the zeolite – sol colloid on the underlying layer.

29. A method of forming a layer in an interconnect structure comprising:

mixing a solution with at least a silicon precursor, a alcohol base, zeolite and water;

depositing the solution on an underlying layer;

gelling the solution into a wet gel; and

calcinating the wet gel.

30. The method of claim 29, wherein depositing the solution comprises dip-coating the underlying layer in the solution.

31. The method of claim 29, wherein depositing the solution comprises spin-coating the solution onto the underlying layer.

32. The method of claim 29, wherein gelling the solution into a wet gel comprises extracting at least some of the solution.

33. The method of claim 32, wherein extracting at least some of the solution comprises oxidizing the solution.

34. The method of claim 32, wherein extracting at least some of the solution comprises heating the solution.

35. The method of claim 29, wherein calcinating the wet gel comprises:

heating the wet gel; and

cooling the wet gel.

36. A method comprising:

forming an etch stop on an underlying layer;

spin-coating a liquid sol - zeolite colloid on the underlying layer;

extracting approximately all of the liquid from the liquid sol – zeolite colloid to form an aerogel – zeolite composite film;

etching at least a via and a trench in the aerogel – zeolite composite film; and

forming a conductive material in at least the via and the trench.

37. The method of claim 36, wherein extracting approximately all of the liquid from the liquid sol – zeolite colloid comprises: oxidizing the sol – zeolite colloid.

38. The method of claim 36, wherein extracting approximately all of the liquid from the liquid sol – zeolite colloid comprises: heating the sol – zeolite colloid.

39. The method of claim 36, wherein the liquid sol is a silica based sol.

40. An interconnect structure comprising:

at least one via opening and one trench defined by a gel – zeolite composite dielectric, which is disposed above an underlying layer;

a barrier layer disposed on the surfaces of the gel-zeolite composite dielectric; and

a conductive layer disposed on the barrier layer.

41. The interconnect structure of claim 40, wherein the gel-zeolite composite dielectric is a wet gel - zeolite composite dielectric.

42. The interconnect structure of claim 40, wherein the gel-zeolite composite dielectric is an aerogel - zeolite composite dielectric.

43. The interconnect structure of claim 40, wherein the gel-zeolite composite dielectric is a calcinated gel – zeolite composite dielectric.

44. The interconnect structure of claim 40, wherein the etch-stop is comprised of silicon nitride.

45. The interconnect structure of claim 40, wherein the barrier layer is comprised of tantalum.

46. The interconnect structure of claim 40, wherein the conductive layer is comprised of copper.